Non-select red oaks

Black oak, *Querqus velutina*
Northern pin oak, *Querqus ellipsoidalis*

The **volume in non-select red oaks has increased** steadily since 1983 especially in larger size classes. However, there are significant differences between the species. The number of black oak trees has declined in all size classes while the number of northern pin oak has increased dramatically. Over half of all volume is located in central Wisconsin.

Growth rates have decreased and **morality has increased** especially for black oak. Whereas non-select red oak species make up about 4% of all volume of trees in Wisconsin, they account for only 1.8% of growth and 7.3% of mortality.

Non-select red oaks are **important timber species**, comprising over 4.8% of removals. The ratio of removals to growth is 146% indicating we remove much more wood than is replaced by new growth. Due to the high density of red oak wood, it may be a valuable source of woody biomass for biofuel production.

- *How has the non-select red oak resource changed?*
  Growing stock volume and diameter class distribution
- *Where do non-select red oaks grow in Wisconsin?*
  Growing stock volume by region with map
- *How fast are non-select red oaks growing?*
  Average annual net growth: trends and ratio of growth to volume
- *How healthy are non-select red oaks in Wisconsin?*
  Average annual mortality: trends and ratio of mortality to growth
- *How much non-select red oak do we harvest?*
  Roundwood production by product and ratio of removals to growth
- *How much is non-select red oak selling for?*
  Prices for cordwood and sawtimber: trends
- *How much non-select red oak biomass do we have?*
  Aboveground biomass by region of the state

"How has the red oak resource changed?"

Growing stock volume and diameter class distribution

The growing stock volume of non-select red oaks in 2012 was about 860 million cubic feet or 4% of total statewide volume (Chart 1). This represents an increase of 37% since 1983 and 25% since 1996.

The red oak resource is maturing; the total volume in small growing stock (5-13 inches dbh) has decreased by 2% since 1983 while the volume in large trees (over 13 inches dbh) has increased by 86% (Chart 2).

There is a significant difference in the percentage change in tree numbers between the two species (Chart 3). The number of northern pin oak trees has more than doubled in all size classes while the number of black oak has decreased.

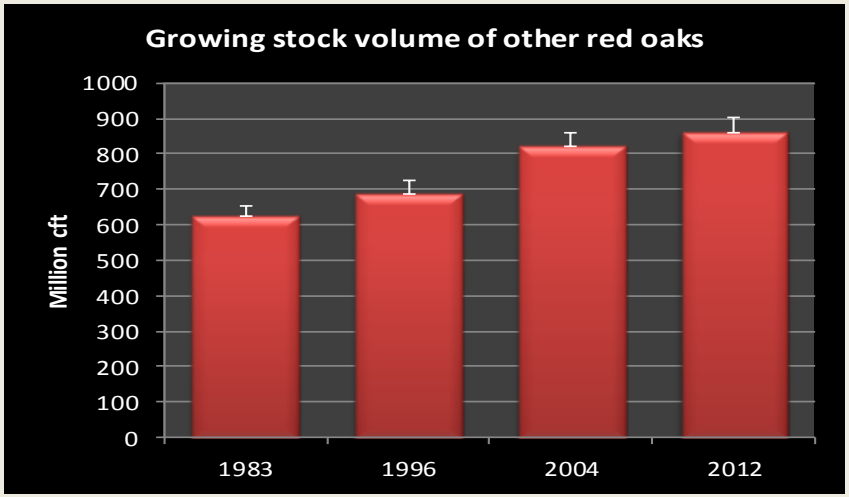


Chart 1. Growing stock volume (million cubic feet) by inventory year.
Source: USDA Forest Inventory and Analysis data: 1983, 1996, 2004 and 2012.

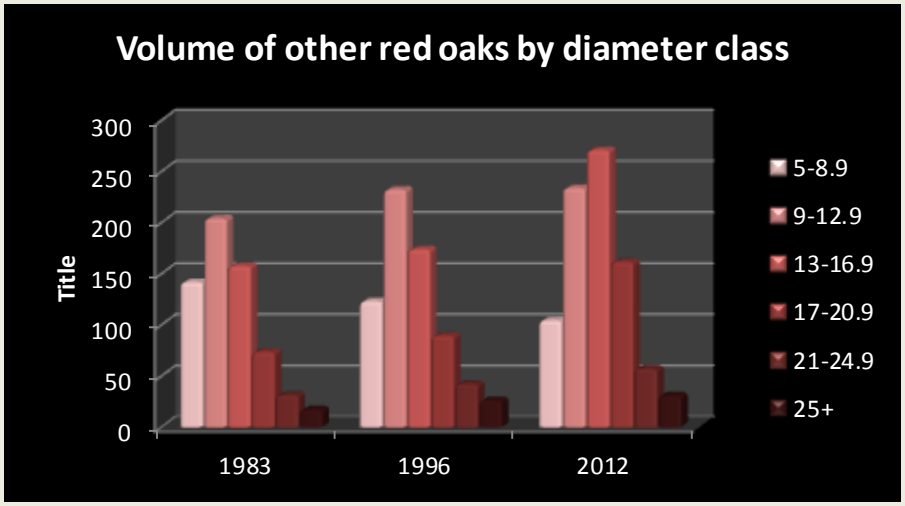


Chart 2. Growing stock volume (million cubic feet) in 1983, 1996 and 2012.
Source: USDA Forest Inventory and Analysis data: 1983, 1996 and 2012.

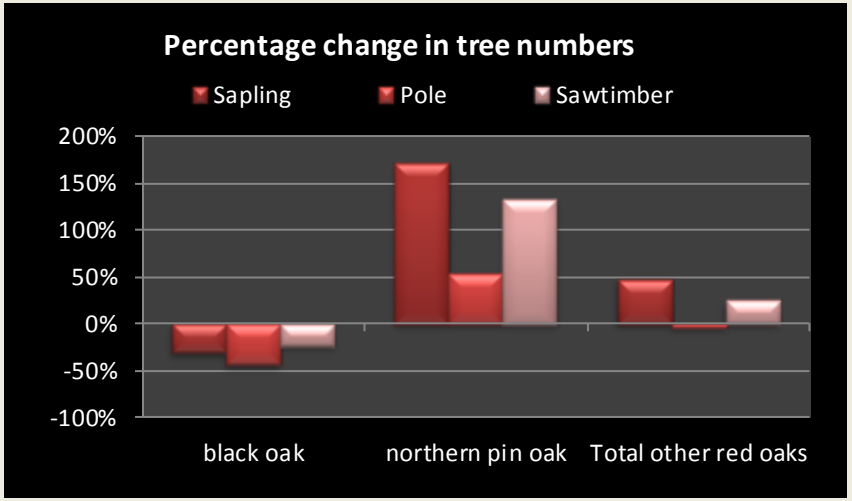
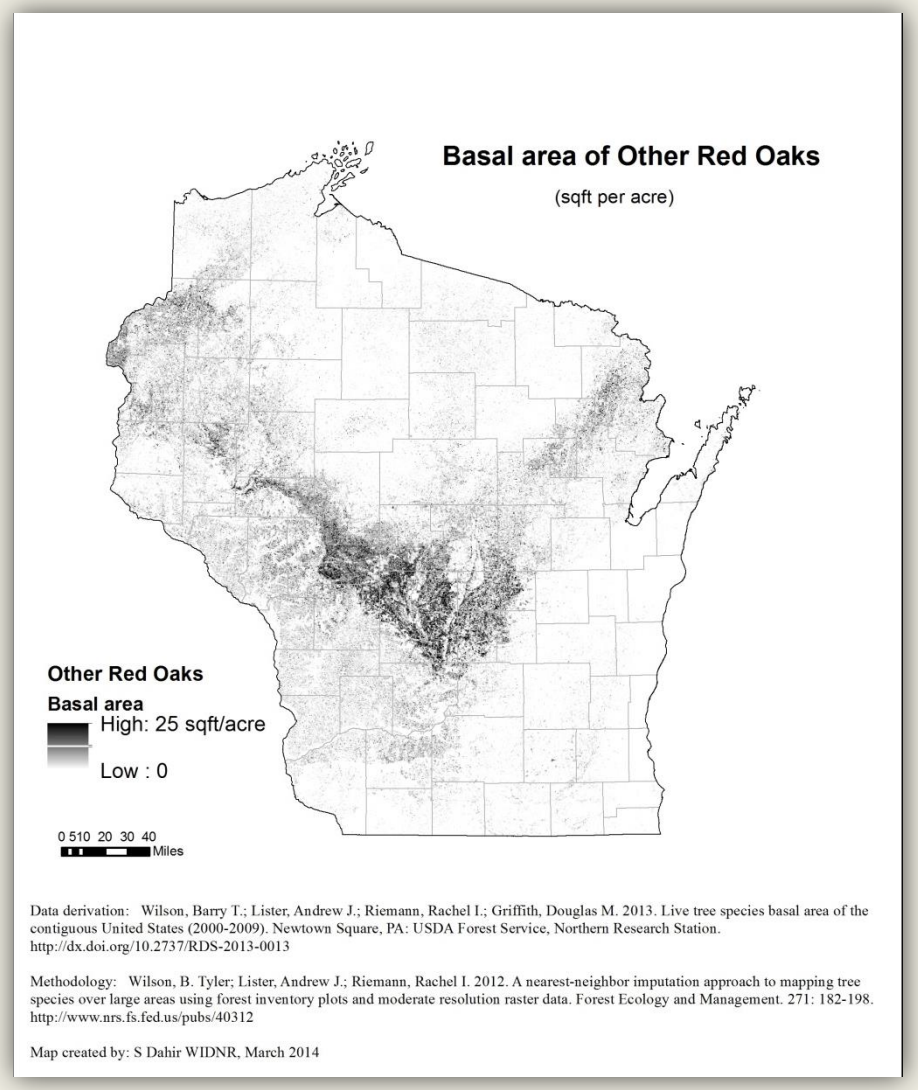


Chart 3. Percentage change in the number of live trees by size class between 1996 and 2012.
Source: USDA Forest Inventory and Analysis data 1996 and 2012.

"Where do non-select red oaks grow in Wisconsin?"

Growing stock volume by region with map



Data derivation: Wilson, Barry T.; Lister, Andrew J.; Riemann, Rachel I.; Griffith, Douglas M. 2013. Live tree species basal area of the contiguous United States (2000-2009). Newtown Square, PA: USDA Forest Service, Northern Research Station. http://dx.doi.org/10.2737/RDS-2013-0013

Methodology: Wilson, B. Tyler; Lister, Andrew J.; Riemann, Rachel I. 2012. A nearest-neighbor imputation approach to mapping tree species over large areas using forest inventory plots and moderate resolution raster data. Forest Ecology and Management. 271: 182-198. http://www.nrs.fs.fed.us/pubs/40312

Map created by: S Dahir WIDNR, March 2014

Over half of non-select red oak volume occurs in central Wisconsin (Table 1).

The majority of volume is found on the white oak / red oak / hickory forest type with lesser amounts on aspen and red pine types. Over half of all volume occurs on very dry to dry and dry-mesic habitat types.

Table 1. Growing stock volume (million cubic feet) by species and region of the state.

Species	Central	North east	North west	South east	South west	Total	Percent of total
Black oak	242	4	-	36	88	**371**	**43%**
Northern pin oak	204	98	118	19	50	**489**	**57%**
Total non-select red oaks	**446**	**103**	**118**	**55**	**138**	**860**	**100%**
Percent of total	**52%**	**12%**	**14%**	**6%**	**16%**	**100%**	

Source: USDA Forest Service, Forest Inventory and Analysis 2012

For a table on **Volume by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/VolumeCountySpecies.pdf

"How fast are non-select red oaks growing?"

Average annual net growth: trends and ratio of growth to volume

The average annual net growth of non-select red oaks was about 10 million cubic feet/year from 2008 to 2012, representing 1.8% of statewide volume growth (Chart 4). Growth rates have decreased 38 %since 1983.

The highest volume growth for non-select red oaks occurs in central Wisconsin (Table 2) but the highest growth to volume ratio occurs in the southeast and southwest parts of the state.

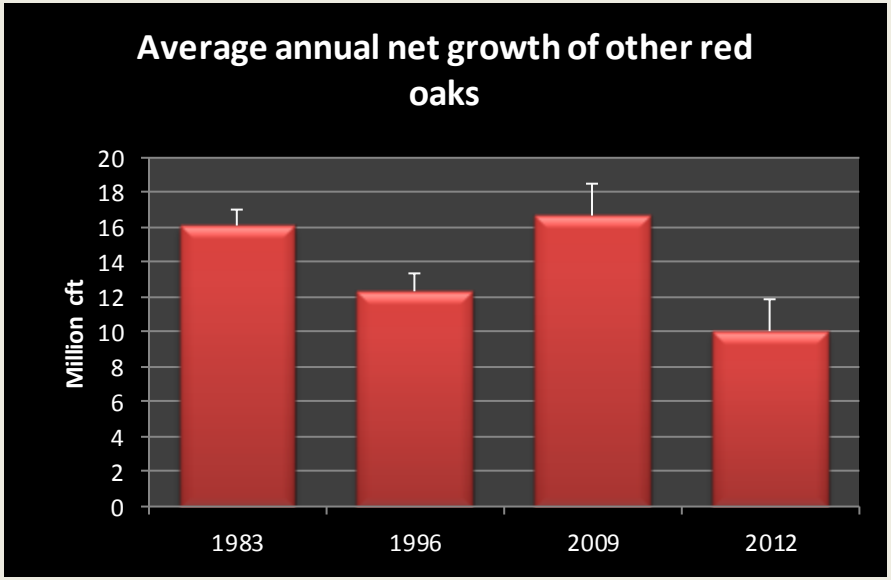


Chart 4. Average annual net growth (million cubic feet).
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2009 and 2012

Table 2. Average annual net growth (million cubic feet/year) of growing stock and the ratio of growth to volume by region of the state.

Region	Net growth	Percent of Total	Ratio of growth to volume
Northeast	1.1	11%	**1.1%**
Northwest	0.9	9%	**0.8%**
Central	4.8	48%	**1.1%**
Southwest	2.2	22%	**1.6%**
Southeast	0.9	9%	**1.6%**
Statewide	**10.0**	**100%**	**1.2%**

Source: USDA Forest Inventory and Analysis 2012

The ratio of growth to volume for non-select red oaks is 1.2%, much lower than the statewide average of 2.6% for all species.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How healthy are non-select red oaks in Wisconsin?"

Average annual mortality: trends and ratio of mortality to growth

The average annual mortality of non-select red oaks, about 17.2 million cubic feet per year from 2008 to 2012, has more than doubled since 1996 (Chart 5). The percent of statewide mortality, 7.3%, is much higher than the percent of total volume in the state, 4%.

The ratio of mortality to gross growth is 63% for non-select red oak species, over twice as high as the statewide average of 28.8% (Table 3). Over ¾ of black oak growth is lost to mortality.

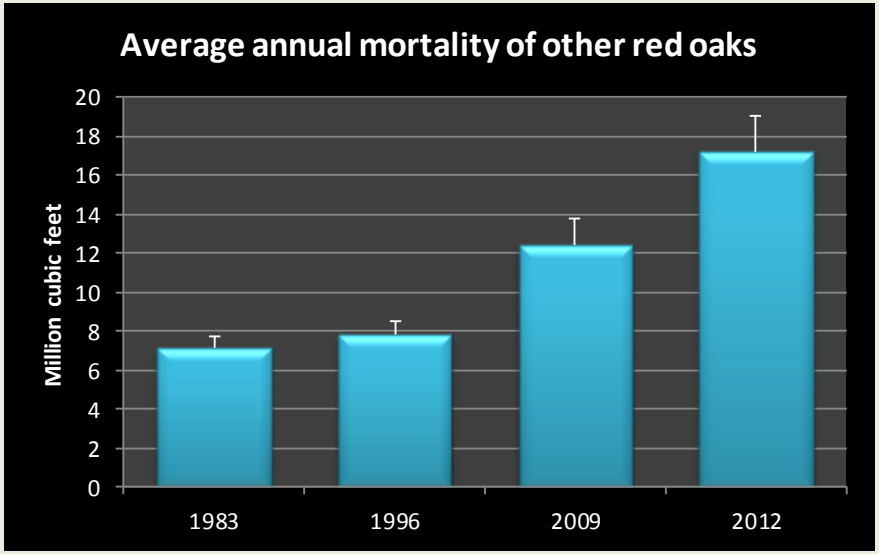


Chart 5. Average annual mortality (million cubic feet) by inventory year.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, 2009 and 2012

Table 3. Mortality, gross growth, and the ratio of mortality to gross growth.

Species	Average annual mortality (cft)	Average annual gross growth (cft)	Mortality / growth
Black oak	8,791,832	11,474,762	**76.6%**
Northern pin oak	8,402,492	15,722,920	**53.4%**
Total non-select red oaks	**17,035,337**	**27,038,695**	**63.0%**

Source: USDA Forest Inventory & Analysis data: 2012

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much non-select red oak do we harvest?"

Roundwood production by product and ratio of removals to growth

In 2009, Wisconsin produced 15.8 million cubic feet of red oak roundwood or about 4.3% of the state's total volume (Chart 6). The non-select red oaks produce about 2% of all pulpwood, 5% of sawlogs and 10% of all residential fuelwood.

Between 2002 and 2009, pulpwood and fuelwood production increased but sawlog production decreased by 42%.

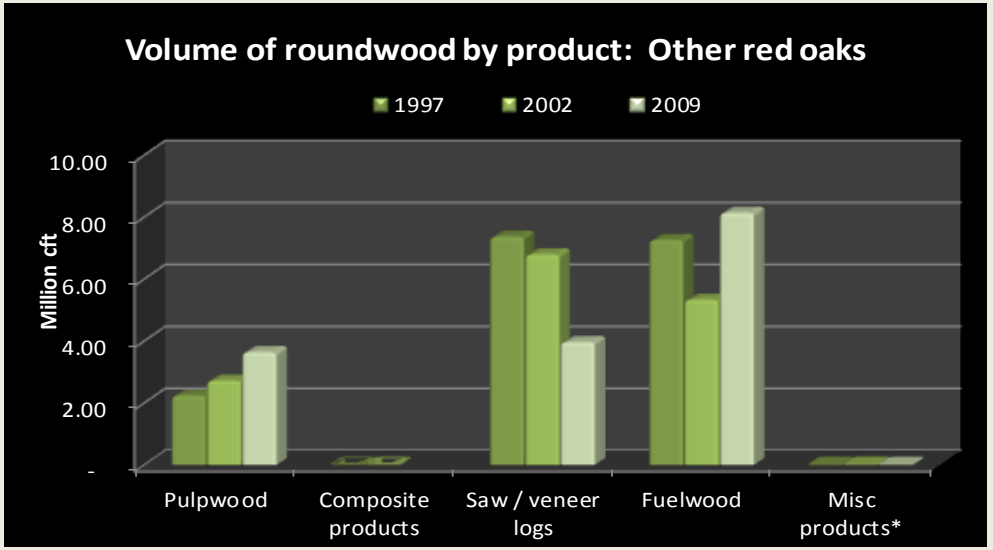


Chart 6. Volume of roundwood products. * Miscellaneous products include poles, posts, and pilings.
Source: Ronald Piva, USDA Forest Service, Northern Research Station, St. Paul MN

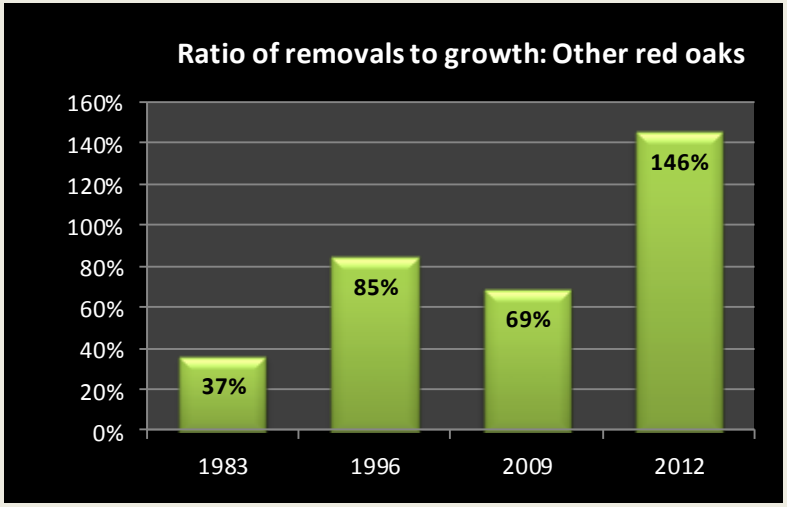


Chart 7. Ratio of volume harvested annually to net growth.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012.

Removals of non-select red oaks averaged 14.6 million cubic feet per year between 2008 and 2012.

The ratio of removals to growth is currently 146% (Chart 7) which means that we are removing much more wood than is being replaced by growth. Much of this is due to high mortality which reduces net growth significantly. The removal to growth ratio for non-select red oaks is almost three times higher than the average of 53.4% for all species in the state.

For a table of **Average annual growth, mortality and removals by region** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/GrowthMortalityRemovals.pdf

"How much is non-select red oak selling for?"

Prices for cordwood & sawtimber: trends

The average stumpage price for non-select red oaks has been falling from its peak in 2004 (Chart 8) but removals of growing stock have generally been increasing, especially in 2012.

Average weighted stumpage values for red oak cordwood and logs as reported in NR46 (Table 4), have fallen from a peak in 2004. Log and cordwood prices are currently lower than the average price for hardwood logs.

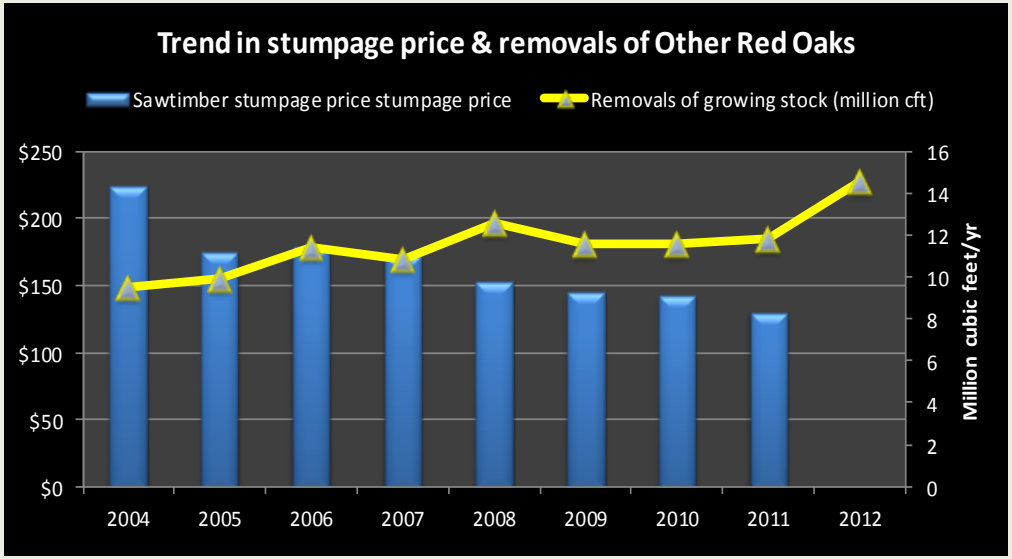
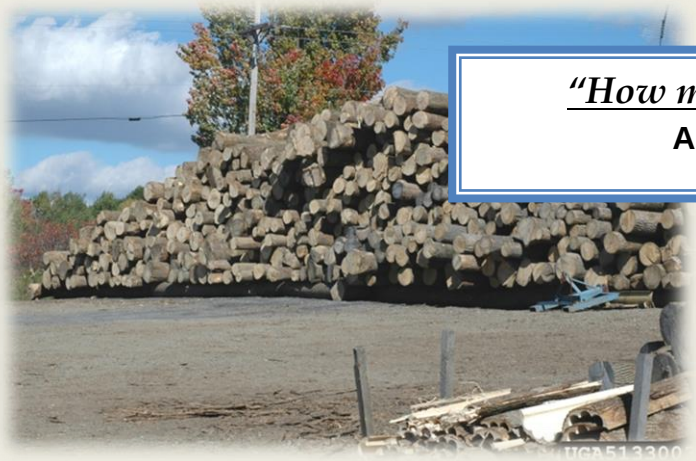


Chart 8. Trends in sawtimber stumpage prices (NR46) and removals of growing stock on timberland (FIA 2012).

Table 4. Average weighted stumpage prices (adjusted for inflation to 2012 dollars) by year for Wisconsin.

Product	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average for all hardwoods
Cordwood (per cord)	$16	$21	$15	$27	$29	$14	$17	$15	$18	**$18**	$24
Logs (per MBF scribner)	$198	$226	$155	$190	$161		$149	$147	$156	**$156**	$237

Source: Wisconsin Administrative Code Chapter NR46, 2002 to 2012. The stumpage values calculated each year are for the sole purpose of assessing MFL yield and FCL severance taxes, not for determining the price that should be received for timber.



"How much non-select red oak biomass do we have?"

Aboveground biomass by region of the state

There were 35.6 million short tons of aboveground biomass in live trees in the non-select red oak group in 2012, an increase of 22% from 1983. This is equivalent to approximately 17.8 million tons of carbon and represents 5.7% of all aboveground carbon statewide. As with volume, most non-select red oak is located in central Wisconsin (Chart 9).

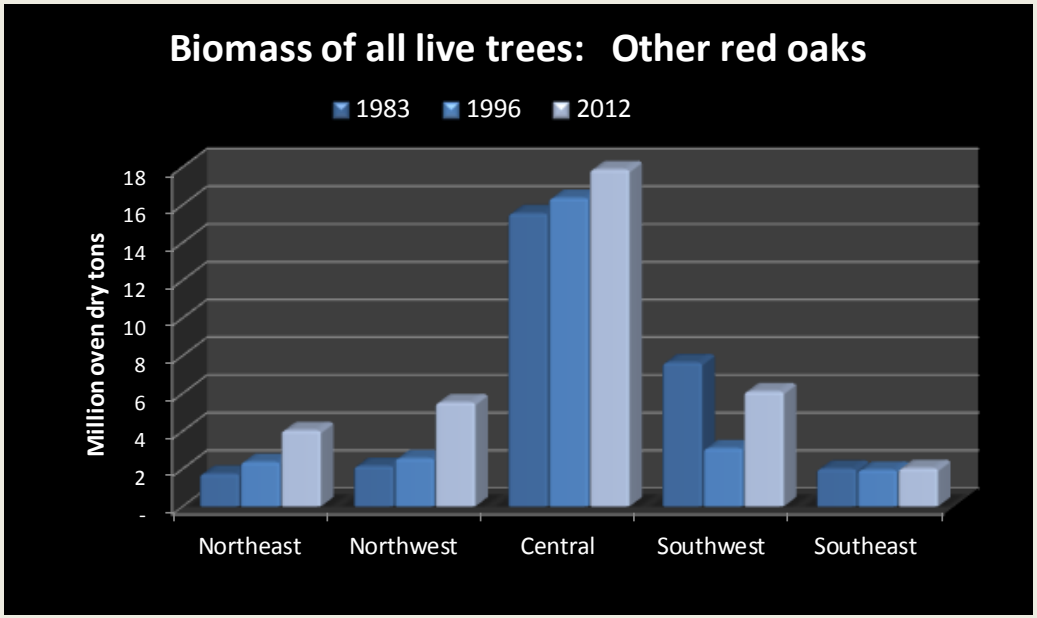


Chart 9. Biomass (above ground dry weight of live trees >1 in dbh, short tons) by year and region of the state.
Source: USDA Forest Inventory & Analysis data: 1983, 1996, and 2012

The density of red oak wood is one of the highest of all species with a ratio of biomass to volume of 42 oven-dry lbs. per cubic foot (ODP/cubic feet). The average for all hardwoods is about 37 ODP/cubic feet and for all species is 33 ODP/cubic feet. Approximately, 73% of all red oak biomass is located in the main stem and 18% in the top branches.

The high volume of non-select red oaks combined with the high density of red oak wood may make it a valuable species for biomass production.

For a table of **Biomass by County for 2012** go to:
http://dnr.wi.gov/topic/ForestBusinesses/documents/tables/BiomassByCounty.pdf